

# Particle Collider: Black Hole or Crucial Machine?

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In this file photo dated Sept. 10, 2008, European Center for Nuclear Research (CERN) scientists control computer screens showing traces on Atlas experiment of the first protons injected in the Large Hadron Collider (LHC).

(AP) -- When launched to great fanfare nearly a year ago, some feared the Large Hadron Collider would create a black hole that would suck in the world. It turns out the Hadron may be the black hole.

The world's largest scientific machine has cost \$10 billion, has worked only nine days and has yet to smash an atom. The unique equipment in a 17-mile (27-kilometer) circular tunnel with cathedral-sized detectors deep beneath the Swiss-French border has been assembled by specialists in many countries, with 8,970 physicists eagerly awaiting the startup.

But despite the expense, thousands of physicists around the world, many of whom hope to conduct experiments here, insist that it will work and that it is crucial to mankind's understanding of the universe.

The European Organization for Nuclear Research, known as CERN, said Friday it would restart the collider in November at

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half power under pressure from scientists eager to conduct experiments to unlock secrets of the universe.

But spokesman James Gillies told The Associated Press they would have to shut down yet again next year to finish repairs so that the Large Hadron Collider can operate at full energy of 7 trillion electron volts - seven times higher than any other machine in the world.

CERN has been working since late last year to repair the damage caused by a faulty electrical joint. The breakdown occurred nine days after the spectacular start up of the \$10 billion machine last Sept. 10 when beams of subatomic particles were sent around the accelerator in opposite directions.

Fifty-three massive electrical magnets had to be cleaned and repaired after the failure. Tons of supercold liquid helium spilled out of the system, and a sooty residue had to be cleared from the tubes that are meant to be pristine, holding a vacuum in which subatomic particles can whiz around the tunnel at near the speed of light at temperatures colder than outer space.

Michio Kaku, a physics professor at City University of New York who is an outspoken critic of waste in big science projects, defends the CERN collider as a crucial investment.

"The Europeans and the Americans are not throwing \$10 billion down this gigantic tube for nothing," Kaku said. "We're exploring the very forefront of physics and cosmology with the Large Hadron Collider because we want to have a window on creation, we want to recreate a tiny piece of Genesis to unlock some of the greatest secrets of the universe."

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He said the biggest cause of the "bad accident" last year was "probably due to human error caused by rushing the project."

"But I view it as a temporary black eye. We'll get it up and running," Kaku said.

CERN expects repairs and additional safety systems to cost about 40 million Swiss francs (\$37 million) over the course of several years, covered by the 20-nation organization's budget.

The collider emerged as the world's largest after the U.S. canceled the Superconducting Super Collider being built in Texas in 1993. Congress pulled the plug after costs soared, and questions were raised about the value of the science it could produce.

Gillies says all 20 of CERN's member nations have remained supportive and that four other countries - Cyprus, Israel, Serbia and Turkey - have asked to join. A fifth country - Slovenia - has expressed interest.

Japan, India, Russia and the U.S. are observer countries that have made sizable contributions to the CERN project.

CERN is now aiming to restart the machine in November with beams of subatomic particles initially running at 3.5 trillion electron volts, or TeV. That's only half the level the machine was designed for, but it's still 3 1/2 times higher than the second most powerful accelerator, the Tevatron at Fermilab outside Chicago. During last year's brief startup phase, the CERN collider only operated at half the Fermilab level.

Even as the machine is being calibrated this winter, scientists will be able to conduct experiments, collecting data on the collisions of protons and lead ions in

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the accelerator.

They hope the higher energy will enable them to see particles so far undetected, such as the elusive Higgs boson, which in theory gives mass to other particles - and objects and creatures - in the universe.

Physicists have used smaller, room-temperature colliders for decades to study the atom. They once thought protons and neutrons were the smallest components of the atom's nucleus, but the colliders showed that they are made of quarks and gluons and that there are other forces and particles. And they still have other questions about antimatter, dark matter and particle mass they want to answer with CERN's new collider.

They hope the fragments that come off the collisions will show on a tiny scale what happened one-trillionth of a second after the so-called Big Bang, which many scientists theorize was the massive explosion that formed the universe. The theory holds that the universe was rapidly cooling at that stage and matter was changing quickly.

Some skeptics have expressed fears the high-energy collision of protons could imperil the Earth by creating micro black holes - subatomic versions of collapsed stars whose gravity is so strong they can suck in planets and other stars.

CERN and leading physicists dismiss the fears and maintain the project is safe.

The collider's teething problems are typical of complicated accelerators, but it has been especially frustrating to physicists from around the world, who already have been waiting for years to conduct their experiments on the machine.

"But the LHC is an example of an

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enormously complicated machine that is pushing the edge of accelerator technology, and it is not surprising that it has had some unanticipated problems," Neal Lane, former President Bill Clinton's science adviser and former director of the National Science Foundation.

If the collider can be started soon, it will produce valuable results, said Lane, now a physicist and public policy professor at Rice University.

But, he added, "If there are many more surprises, further delays, failure to meet design specifications over the next few years, then the field of experimental particle physics, worldwide, could be set back for a decade or more. The stakes are very high!"

Gillies told the AP that CERN management decided at the beginning of the year that it would not try to repair all parts of the collider this year.

"Otherwise, we would never have had a beam before halfway through next year," he said.

Gillies said CERN experts have examined every one of the 1,600 superconducting magnets and each of the 10,000 electrical splices as well as copper protection to carry away any spillover current to prevent damage to the magnets if they heat up as happened Sept. 19.

They decided some of the splices need to be repaired before the collider goes to full power, but that they can operate safely up to 5 TeV without further repairs now.

That has been set as the highest energy for the collider before its next shutdown for maintenance, probably in November 2010. Then the further repairs will be made so that the energy level can be

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ramped up.

Rolf Heuer, who has taken over as CERN's director-general since the failure, said the collider has been studied very carefully and is much better understood than a year ago.

"We can look forward with confidence and excitement to a good run through the winter and into next year," Heuer said.

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